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THE VEGETATION OF THE SARGASSO SEA.

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On September 16, 1492, Columbus encountered masses of floating seaweed in latitude 28° N. 58° W. as he was approaching the Bahama Islands. This is the first record of the existence of what is now known as the Sargasso Sea. Since that date many navigators and travellers, who have traversed that region, have described the general appearance of the sea and have attempted to ascertain its limits and to explain the source from which the floating gulf-weed was derived. Unfortunately, however, the earlier accounts were often rather vague and to some extent conflicting and even well-known scientific men, as Humboldt, have been too much inclined to call attention to the sea as one of the wonders of nature rather than to attempt to record the facts about it accurately. Humboldt, for instance, described the Sargasso Sea as an area six times as large as Germany covered with a growth of a single species of seaweed which he regarded as very remarkable considering the small size of the land areas covered by the growth of a single species of plant. Although Humboldt's account is in a sense true, the impression that those who read his account receive is misleading.

The account given by Alexander Agassiz in 1888 was less sensational. He says:

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"The Sargasso Sea of the North Atlantic covers a rather indefinite area between 22° and 36° N. and according to the statements of the older navigators, the amount of Sargassum to be met with varies from occasional patches to masses large enough to impede the progress of sailing vessels. The Sargassum probably changes its position constantly, according to the seasons, the currents, and the direction of the wind; but within the area bounded by the Gulf Stream on the West, the equatorial current on the South and the return current from the Azores and Canaries the Sargassum has always been found in larger or smaller quantities."

At the present day we have a definite knowledge of the ocean currents and the prevailing winds of the Atlantic which are important factors in the distribution of the gulf-weed. My personal experience, which has been confined to that part of the Ocean lying between New York and Bermuda, agrees with that of most recent travellers who have traversed the Sargasso Sea in various directions and it may be said that the gulf-weed occurs in scattered patches which are usually from fifty to, at the most, a few hundred feet in diameter. It appears to be certain that in no place is the Sea covered by the gulf-weed in continuous masses miles in extent and it is not often the case that the patches extend over a space as large as an acre. Their long diameter is usually in the direction of the wind and their frequency varies very much according to circumstances. Whether they are ever so dense as actually to impede modern sailing vessels seems to me doubtful, and it must be said that those who make the statement that the progress of vessels may be impeded by the gulf-weed usually preface their remarks by saying 'according to older navigators' and do not depend on their own observations.

If at the present day we have a good topographical knowledge of the Sargasso Sea, the question as to the particular species to which the gulf-weed belongs still presents several perplexing problems and, as to the origin of the gulf-weed, as recently as 1907 Sauvageau wrote: "les causes de sa formation ne sont guère mieux connues que lors du premier voyage de Christophe Colomb." Sargassum, to which the gulf-weed, *Sargassum bacciferum*,[1] belongs is

[1] The name *Sargassum bacciferum* is used here since it has been the name most commonly used to designate the gulf-weed. Boergesen in his paper, "The species of *Sargassum* found along the coasts of the Danish West Indies with Remarks upon the Floating Forms of the Sargasso Sea," Copenhagen, 1914, states fully the reasons for preferring the name *Sargassum natans* (L.) on the ground of priority.

a large genus, the largest of all the genera of the larger brown seaweeds, and includes mainly species which inhabit the tropics, or more accurately between about 42° N. and 42° S. latitude. They flourish just below low water mark but do not grow in deep water. They are attached to the substratum by a hold-fast and grow not infrequently to be three feet long, with a branching, slender stem bearing leaves with small, stalked air-bladders near their bases. The fruit, the spores, are in cavities on special branches. The genus is a difficult one for the systematic botanist because, to be sure of a species, one should have not only the stem with its leaves but also the base and the fruit and in many cases species have been described from fragments only. Furthermore the individuals of most species vary very much so that, without a study of a set of living specimens, an algologist might be pardoned for believing that he had not one but several species before him, judging by herbarium specimens only. The points I have just mentioned must be borne in mind in what I have to say about the gulf-weed. It remains for us to consider the two questions: What is the gulf-weed and where does it come from?

All observations agree that the masses of floating gulf-weed consist in far the greater part of the single species, called *Sargassum bacciferum*. If, however, we examine more closely the traditional gulf-weed we find that although it has the characteristic leaves and bladders of the genus, it has no remains of a basal attachment and no fruit except in certain very rare and not well authenticated cases. Some believing that, if not impossible, it is certainly very improbable that any species could continue to flourish indefinitely like the gulf-weed without at some time fruiting and, furthermore, seeing a certain resemblance of the leaves and bladders to those of certain species of Sargassum growing attached in the West Indies and on the Florida coast, have advanced the opinion that the floating form called gulf-weed consists of branches broken from the attached forms and carried by the gulf stream to the different parts of the Sargasso Sea. Others maintain that this is not the only case of a plant living and flourishing without producing fruit, and that, since up to the present time, no one has found the *Sargassum bacciferum* attached and fruiting, we are forced to believe that it is a distinct but always sterile species and not a form of any other attached

species. This latter opinion is the one held by most recent writers.

The question is not as simple as it seems at first sight. It may be asked whether *Sargassum bacciferum* occurs in other places than the Sargasso Sea and its immediate vicinity. What has been considered to be this species has been reported to occur in New Zealand, Australia, Java and various places in the Pacific and Indian Oceans as well as Valparaiso but only scattered specimens have been found and there is no evidence whatever that there is more than one Sargasso Sea in the world and it may be questioned whether all the specimens supposed to be *S. bacciferum* from other regions are really the same as the Atlantic form. I have a specimen marked New Zealand which seems to be the real gulf-weed but the data on the label are scanty and I do not feel sure that the locality is correctly given. Von Marten's theory that the gulf-weed originated in the Indian Ocean and was carried by currents round the Cape of Good Hope to the Sargasso Sea has nothing to support it, nor can the theory of Ed. Forbes that the floating gulf-weed is the survival of Sargassum growing on the submerged Atlantis be seriously considered.

As a waif, or straggler, the gulf-weed is occasionally deposited on the shores of northwestern Europe but in Great Britain, at least, it must be very rare for in his Phycologia Britannica Harvey was obliged to draw his figure of *L. bacciferum* from an American, not a British specimen. On the east American coast specimens of the gulf-weed are very rare. The only specimen which I have is a fragment washed ashore at Bath, Long Island. Some years ago I was told by a sea captain that there was a bank of gulf-weed off Nantucket but I have been unable to obtain any confirmation of this statement. Even if there is such a bank, the chances are that it is composed of *S. filipendula,* which is very abundant on the adjacent shore of Cape Cod.

As has been said, by far the greater part of the gulf-weed masses is composed of *S. bacciferum.* That it is exclusively so is not true. Agardh states that *S. Hystrix* is found with *S. bacciferum* and recently Boergesen has reported the same species near the Danish West Indies; *S. vulgare,* a very common attached species of the West Indies has also been found with the gulf-weed. The mixture

of the two species does not appear to be common in the Sargasso Sea itself but, as one approaches the land, the floating *S. vulgare* mixed with *S. bacciferum* is common and one finds both common even on the surface of landlocked waters like Harrington Sound, Bermuda.

A very interesting case is that of the mixture of a species of Cystoseira and gulf-weed collected by Professor F. H. Storer on a voyage from the Cape of Good Hope to New York. The exact position cannot be stated but according to information given by Professor Storer it was approximately 10° N. by 40° to 45° W. One gathering only was made and from it was obtained the specimens of *S. bacciferum* distributed in the "Algæ Americæ Borealis" of Farlow, Anderson and Eaton. This set has been seen by all the well known algologists of the world and, as no one has questioned the determination, it may be supposed to be correct. The Cystoseira was entangled in the Sargassum. The species of Cystoseira are complicated and not easy to name and the specimens in question were not in fruit. As far as I could tell, the species appeared to be very near *C. crinita* Bory, a Mediterranean species. Specimens have been examined by Sauvageau, the expert student of the genus, whose opinion is that in spite of certain points in common with *C. crinita* he would not venture to assert that they belong to that species. The interesting fact, however, is that, whether *C. crinita* or not, it must have come from the southeastern shore of Europe or of Northern Africa including the Atlantic islands since the species of Cystoseira abound in that region and, with one exception, none are found on the east coast of North America. *C. Myrica* is a rare species of Florida and the Bahamas and is quite different from the floating Cystoseira. As far as could be told from the material collected by Professor Storer, the Cystoseira in spite of its long journey was in as good a condition as the gulf-weed with which it was found. This is instructive as showing how far specimens can be transported by currents without perceptible injury.

In conclusion, in the limited time at our disposal, I shall show you a few slides of the gulf-weed and related species to illustrate more clearly some of the points I have mentioned. Everything considered it seems to me that in the present state of our knowledge we

are not as yet warranted in assuming that the floating gulf-weed could not have been derived originally from some fixed, fruiting form. Certainly we do not at present know from what species it might have been derived but, until the distribution of the Sargassa on the eastern coast of America and the West Indies is better known and the characteristics and variations of the various described species have been more thoroughly studied, the question of the origin of the gulf-weed seems to me to be still open.